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Flexible Videoscope/Borescopes Articulation

Pushing the limits of articulation and maintaining reliability

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How does Olympus lead in the world of reliable and precise articulation.

- Quick Olympus Overview
- Basic Videoscope Structure
- The Challenges Faced by Inspection in Space
- Zero Gravity Scope (VAU)
- Types of Articulation, Their benefits and drawbacks
  - Low force direct articulation IPLEX Ultralite by Joystick
  - Power Assisted Articulation IPLEX Series by Joystick
  - Servo Articulation IPLEX SX Series by Joystick
  - Geared Manual Articulation Olympus Medical
  - Pneumatic Articulation
  - Hydraulic Articulation
  - Multi Articulation
- Bringing it all together – Know How

Track Record of Innovation in Remote Visual Inspection

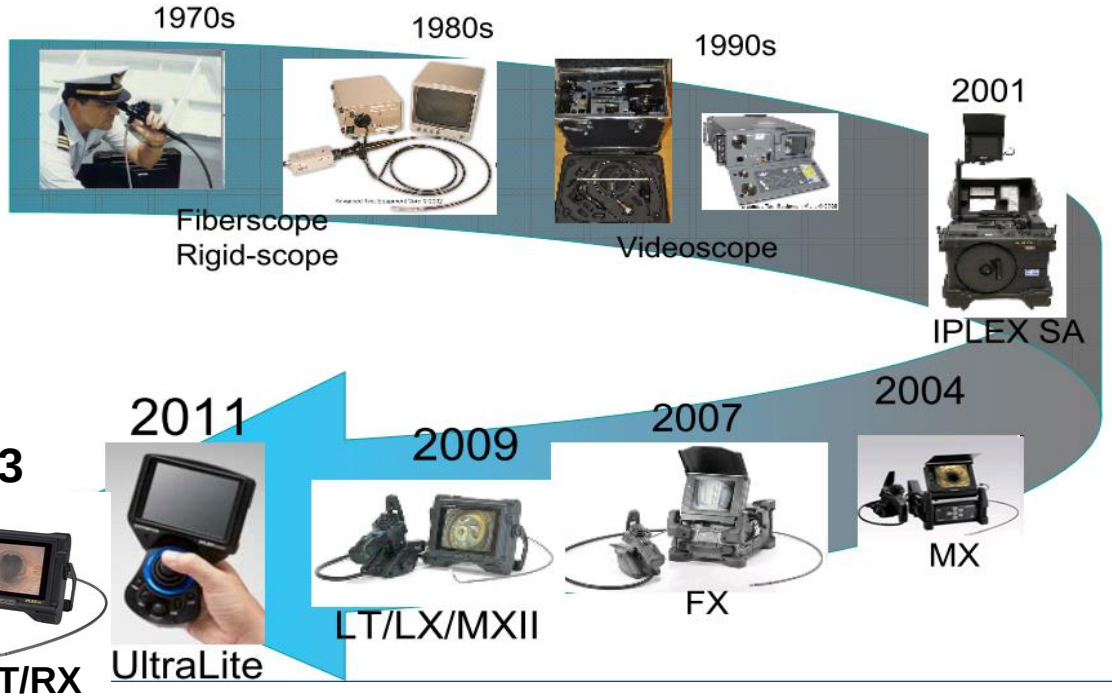
1949 – First Gastrocamera

1964 – First Gastrocamera With Fiberscope

1982 – First Medical Video And Ultrasound Endoscopes

2002 – First High definition Videoscope system

1999 Eye-Trek

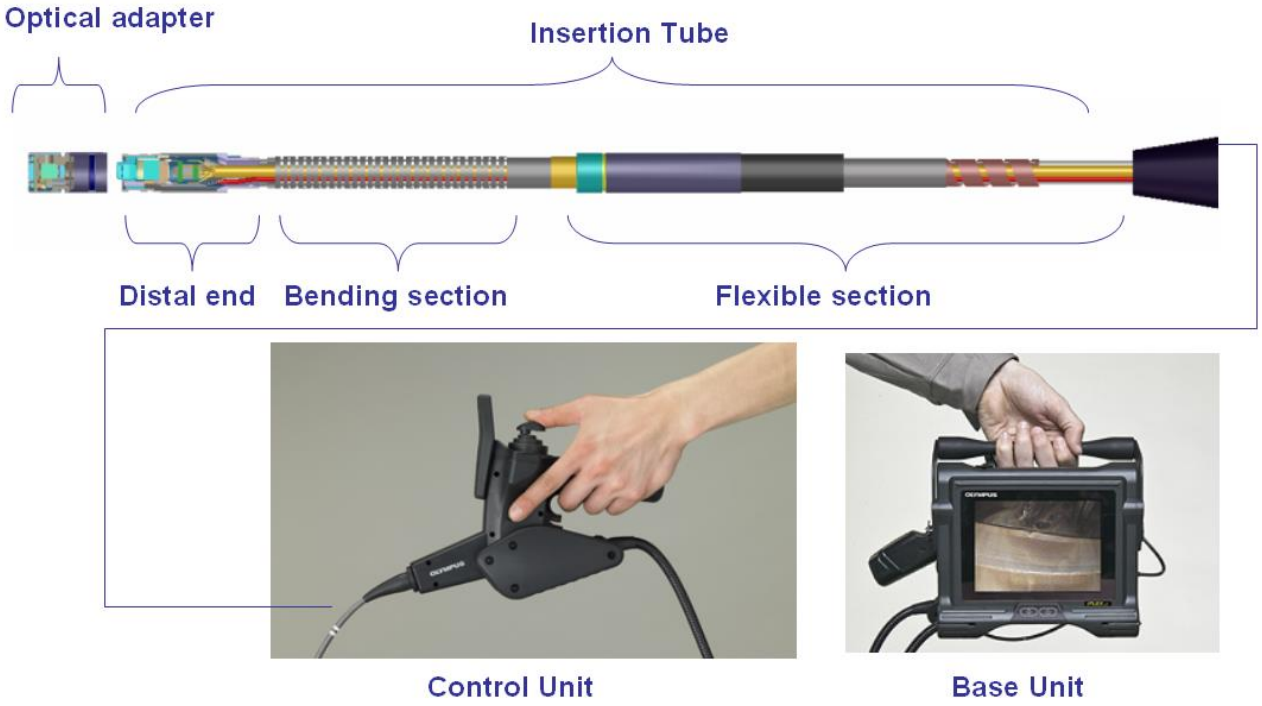


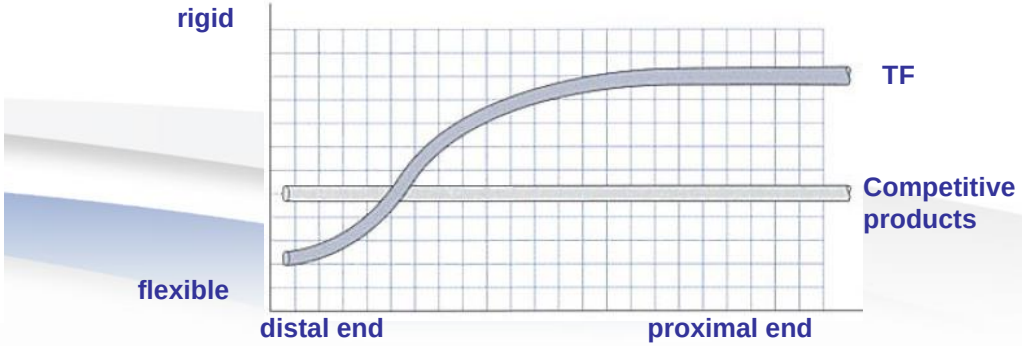
2009 – First 3D Measurement Laser Microscope

2007 – First High Resolution Capsule endoscope

Basic Videoscope Structure

Olympus constantly fine tunes the basics of Videoscope Structure, with small advances to make scopes more user friendly. From power assisted True Feel Articulation to Taper Flex© Technology.



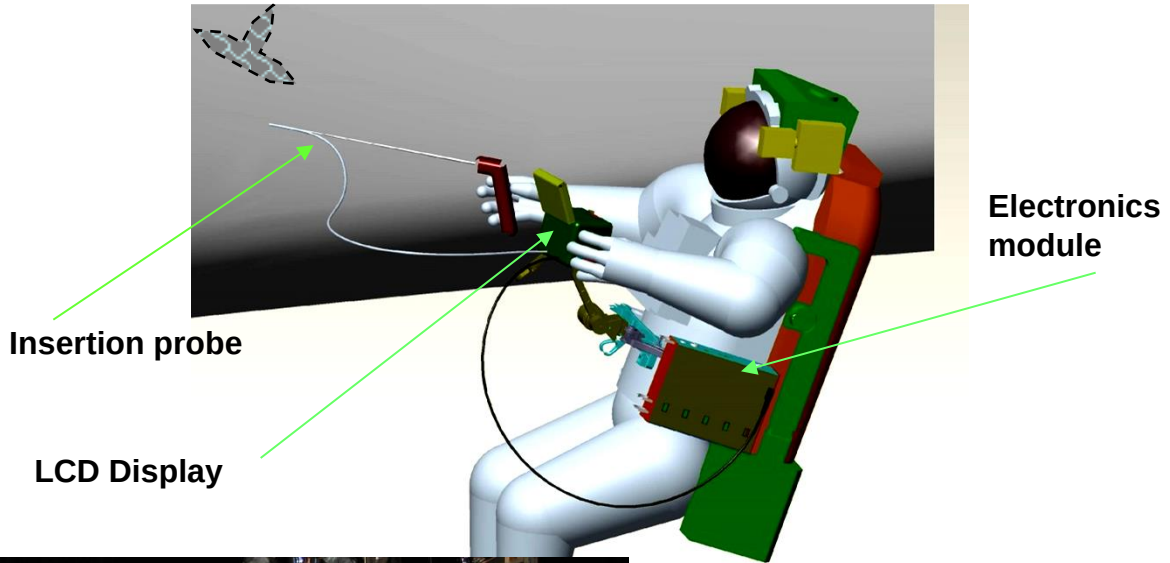


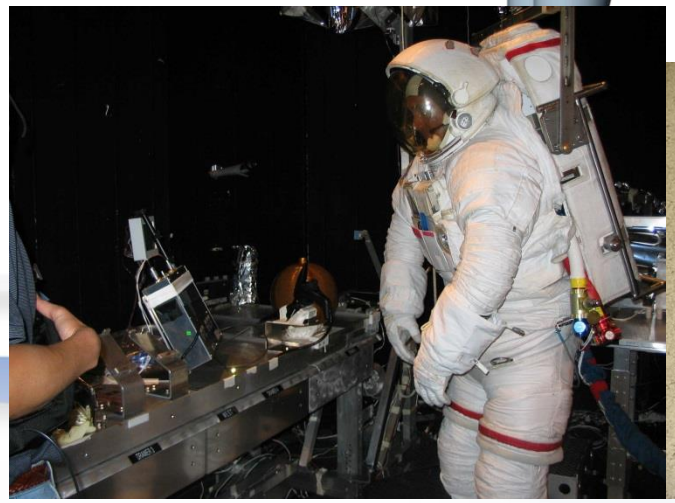
Challenges of Inspection in Space

- Inertia – Why won't it stop?
- Air – or lack there of effecting pressures in the construction.
- Handling – Hard to be dexterous with these….
- Temperature, variations – Precision is a relative thing.

Zero Gravity – VAU Project

•Olympus has worked with NASA on Projects to advance the limits of remote visual equipment

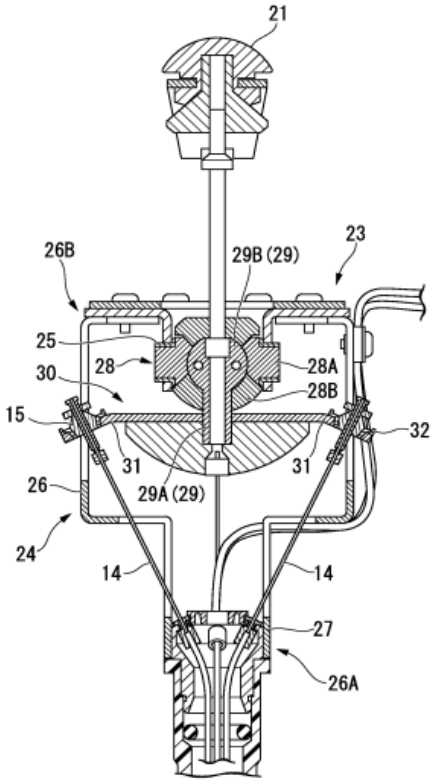




Types of Articulation

- Having established the challenges of the inspection, review of the technologies available is critical to evaluating an effective solution.
- What are the benefits and complications

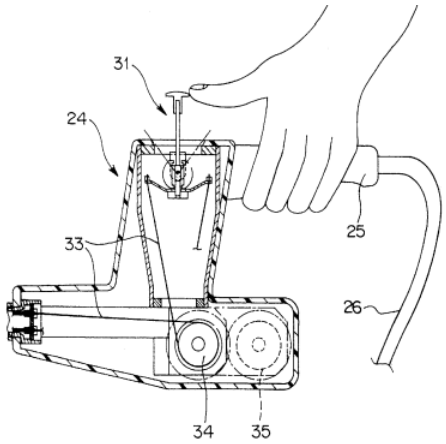
Low Force Direct Articulation



- PROS
  - Direct Articulation provides exceptional control and feel
  - Stresses are kept to a minimum
- CONS
  - No automation possible
  - Force limited by thumb, length and articulation amount is therefore limited

- Olympus Patent 8,758,230 B2 June 24, 2014

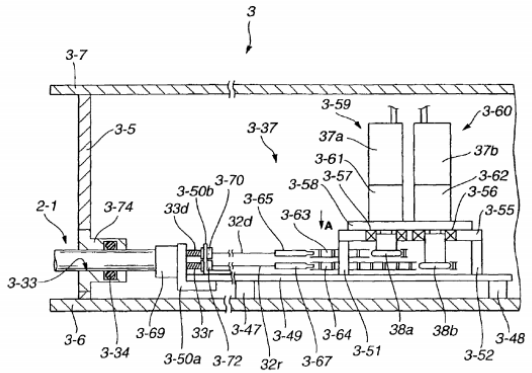
Power Assisted Articulation



- PROS
  - Power Assisted Articulation provides good control and feel
  - Power assistance provides greater range capability
  - Stresses are kept to a balance
- CONS
  - No automation possible
  - More complex/larger

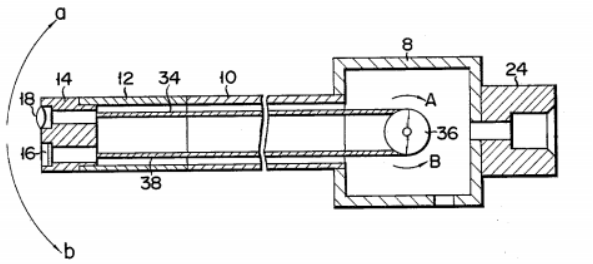
- Olympus Patent 6,793,622 B2 Sept 21, 2004

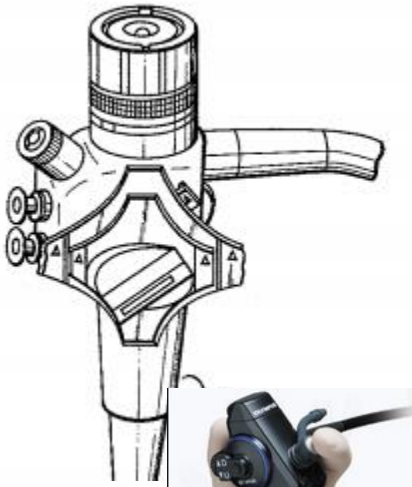
Servo Articulation



- PROS
  - Exceptionally powerful for amazing length
  - Remote and automated control are possible
- CONS
  - No feel or feedback, relative slow response
  - Forces applied can prematurely stretch cables
    - Olympus Patent 7,104,951 B2 Sept 12, 2006

Direct Geared Articulation

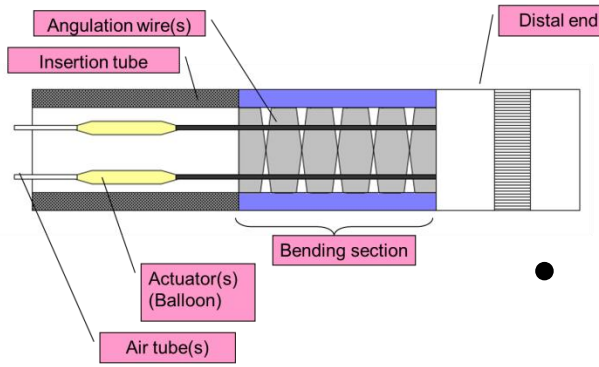




- PROS
  - Exceptional feel and control
  - Stresses are kept to a minimum
- CONS
  - No automation possible
  - Force limited by thumb, short length only
  - 2 way articulation with thumb only.

- Olympus Patent 4,286,585 Sept 1, 1981

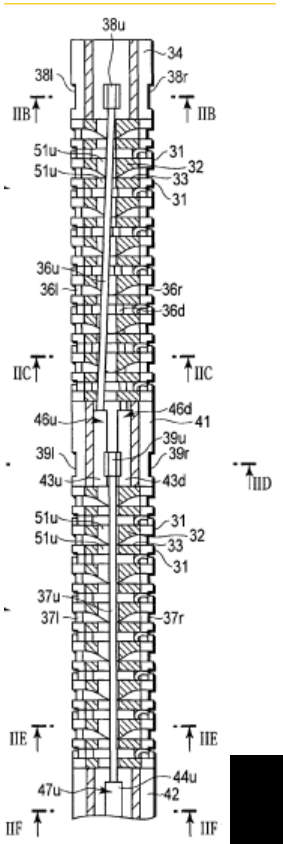
Pneumatic Articulation



- PROS
  - Operational at very long distances
  - Minimal components to stretch/wear
- CONS
  - Slower reaction times
  - Requires more real-estate inside insertion tube
  - Susceptible to outside pressures

- Olympus Patent Filed

Multi-Articulation



- PROS
  - Exceptional feel and control
  - Ability to reach and arrive at locations previously impossible or difficult
  - Stresses on the cables kept to a minimum
- CONS
  - No automation possible in current configuration
  - Complex control
    - Olympus Patent 8,777,843 July 15, 2014

Bringing it all together

- No solution is perfect for inspection in space
- There are pros and cons to all the technologies
- Sources outside Olympus may have more advanced electronic and intelligence systems
- So why is Olympus here, and what can we provide to the efforts of in space inspection?

We Bring Know How

- With hold over 1374 endoscope patents in the US alone.
- This know how provides the most durable and reliable core mechanisms in the endoscopic world. Critical for anything going to space.
- We are constantly seeking methods to make our customers, their interests and patients to have the very best in outcome and reliability.
- Perhaps together with other technology leaders, we can work towards serving both NASA’s needs, and our customers.

Any Questions?

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